After The Hague, Bonn and Marrakech : the future international market for emissions permits and the issue of hot air

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DE POLITIQUE DE L'ENERGIE

CAHIER DE RECHERCHE N° 27BIS

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Janvier 2002

Partial funding from Institut Français de l'Energie (IFE)
was provided for the realization of this paper

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Introduction

In 1998, the fourth Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) held in Buenos Aires, Argentina, defined the Buenos Aires Action Plan (BAPA). The BAPA called the Parties to work on ‘core issues’ aimed at facilitating the implementation of the Kyoto Protocol: flexibility mechanisms, compliance, adverse effects, technology transfers, policies and measures, land-use, land-use change and forestry (LULUCF). The core issues were due to be resolved for the sixth Conference of the Parties (COP-6) in November 2000. But COP-6 failed to reach an agreement among Parties and decision was taken to resume the discussion at a 'COP-6 bis' conference in Bonn in July 2001.

Meanwhile the US Administration changed and newly elected President George W. Bush clearly stated in March that the US rejected the Kyoto Protocol as a ‘fatally flawed agreement’. Despite various pressures for the US to rally the process engaged since Kyoto in 1997, the US Administration attended the Bonn conference as an observer only. Surprisingly, however, a major positive outcome emerged during 'COP-6 bis' as Parties managed to reach a political –though not legally binding- agreement, the so-called ‘Bonn agreement'. In addition to recognizing the need for new and additional funding, the Agreement laid the bases for decisions on transfer of technologies, minimization of adverse effects, commitments, mechanisms, compliance and the taking into account of LULUCF. The Agreement was translated into operational terms at COP-7 in Marrakech (29 October - 10 November 2001). The outcome, the ‘Marrakech Accords’, paves the way to the ratification of the Kyoto Protocol and its possible entry into force within not too distant a future.

More precisely, with respect to the LULUCF, the Parties agreed on a methodology for accounting for sinks credits that would add up to the assigned amount of a Party. In addition to projects achieved domestically or through Joint Implementation, afforestation and reforestation projects are considered as eligible under the Clean Development Mechanism (CDM) up to 1 % of base year emissions, during the first commitment period[1].

The main objective of this paper is to assess the Bonn-Marrakech agreement, in terms of abatement cost and emission trading as compared with the initial agreement reached in Kyoto (the Kyoto Protocol). Our reference case (the 'Initial Deal’) does not include the use of sinks credits, as the Kyoto Protocol does not give explicit figures nor method to estimate them. In addition, two hypothetical situations are considered. The first describes the “missed compromise” that could have emerged among all Parties in November 2000 in The Hague. The second is a virtual case where the US is assumed to be part of the Bonn-Marrakech Agreement, along with all the other Parties. These two cases contribute to shed the light on the Bonn-Marrakech Agreement potential pitfalls.

In the current situation, the US is out of the negotiation process and has no emission reduction commitment. Given the projections of carbon dioxide (CO_2) emissions used in this study, the Former Soviet Union countries (FSU) and the Eastern European Economies (EEE) that are

[1] For official documents about the Conferences of the Parties, visit web pages : http://www.unfccc.int/resource/docs.html

part of the Annex B have potentially enough ‘Hot Air’ to fulfill the overall commitment of the Annex B bubble, without any domestic abatement effort from the other Annex B countries (the "Annex II" countries of the Convention[2]). We show that in the theoretical case where no limit would be imposed on the selling of Hot Air, the permit price according to the POLES model would be zero as no market equilibrium could take place.

This is why, next, we examine the economic impacts of restrictions to hot air trading, for FSU and EEE as well as for the other countries. We shed the light on the potential market power of the former countries that arises from the Bonn-Marrakech Agreement.

[2] UN Framework Convention on Climate Change, 1992, Annex II, available on : http://unfccc.org/resource/conv/annex2.html, accessed 10/10/2001

Technical notes on the study

All the quantitative results presented in this paper stem from the POLES[3] model and the ASPEN[4] software developed at IEPE. POLES is a model of the world energy system that simulates energy demand and supply on a year-to-year basis, up to 2030. The world is described with 38 countries or regions and 15 main energy demand equations for each country. 24 power generation technologies, of which 12 new and renewable technologies are explicitly incorporated. The POLES model also projects the energy sector's CO_2 emissions up to 2030 as well as the marginal abatement cost curves for these emissions in each of the 38 countries or regions.

The ASPEN software input data consist in the Marginal Abatement Costs assessed for the various countries / regions with the POLES model. They allow to simulate emission permits supply and demand in 2010 (chosen as a representative year for the first commitment period) for any specific market size and hence to determine a market equilibrium price (the emission permit price). Trade is assumed to take place on a perfect competitive market.

The study focuses only on CO_2 emissions and does not consider the emission reductions of the other greenhouse gases (GHGs) mentioned in the Annex A of the Kyoto Protocol. Work is underway to incorporate other GHGs in the model. As carbon dioxide is by far the main anthropogenic GHG, we assume here that the main conclusions and the general trends will hold, if the other GHGs are included.

The first part of this study deals with the economic consequences of the Kyoto Protocol that was agreed upon in 1997. This is the 'reference case' or 'Initial Deal' (ID). The hypothetical compromise in The Hague is then examined (referred to as the Missed Compromise, or MC). The Bonn-Marrakech Agreement is assessed in the third part, starting with the (unrealized) hypothesis that the US takes part in the Agreement (scenario BM_0) and ending with the analysis of the actual agreement reached (BM_1). Eventually, using the ASPEN software results, the fourth part deals with the analysis of the restriction on the hot air trading and the impact of the market power of FSU and EEE.

For all cases analyzed below, the emission reduction objectives are those set for the Annex B countries in the Kyoto Protocol. These objectives can be achieved through domestic reductions as well as through the three flexibility mechanisms adopted in the Protocol: International Emission Trading (IET), Joint Implementation (JI) and the Clean Development Mechanism (CDM). As stipulated in the Marrakech Accords, we consider that the emission reductions gained through these three mechanisms are totally fungible, which means that all units may be transferred several times between Parties and/or legal entities

[3] POLES stands for Prospective Outlook on Long term Energy Systems.
[4] ASPEN stands for Analyse des Systemes de Permis d'Emission Negociables, i.e. analysis of emission permit systems.

As already explained at length in the economic literature on Climate Change (Criqui and al., 1999 ; Energy Journal, 1999), Annex B countries are supposed to import units of emission reduction through these flexibility mechanisms when the marginal cost of domestic reductions is greater than the international emission permit price.

1. The Reference Case, or the ‘Initial Deal’ (ID) of the Kyoto Protocol

Various assumptions are adopted to build the 'Initial Deal' (ID) case. All Annex B countries take part in emission trading, as all of them initially adopted the Kyoto protocol. A 10 % ‘CDM-accessibility factor’ is considered as a reasonable hypothesis, meaning that only 10 % of the overall potential emission reductions from non-Annex B countries' energy sectors are considered as being feasible CDM projects. This accessibility factor originates in the possible institutional pitfalls or technical difficulties in the identification, definition and implementation of the projects (lack of infrastructures or expertise for instance), as well as in the difficulty of estimating the corresponding baselines.
Furthermore, transaction costs are associated to all CDM projects to account for the costs of various procedures inherent to the implementation of any project (administrative procedures or certification of the reduction units for instance). They raise the cost of the reduction of a ton of carbon and are supposed here to be 20% of the technical cost.

The ID scenario does not account for any sinks in the emission reductions. While the Kyoto Protocol includes provision for sinks in the Articles relating to land-use, land-use change and forestry (LULUCF), no actual figures are provided. The accounting method is left to the following Conferences of the Parties. Excluding sinks from the Reference Case aims at showing what the negotiations following those in Kyoto brought in economic terms, when sinks allow the different Parties to lower their emission reductions.

Similarly, although the Kyoto Protocol explicitly calls for some ‘share of proceeds’ to assist the developing countries in meeting the costs of adaptation to climate change, no share of proceeds is included in the Initial Deal as defined here.

Under these conditions, the international permit price would be 48 \$/tC[5] (Table 1 below).

Table 1 : The ID scenario, costs and emission reductions

Permit Price at equilibrium (\$/tC)	48

Results summary of current scenario		Purchasers (MtC)				Sellers (MtC)				
						Exports				
Countries	TAC (M95\$)	Required emissions reductions =	Dom. Red. to reach target	+ Imports	+ Sinks (dom.+CDM)	CDM (without sinks)	Dom. Red. for IET / JI	Traded Hot Air	Sinks in EEE and FSU	HA balance
USA	19755	513	186	327	-	-	-	-	-	-
Europe	4990	136	61	75	-	-	-	-	-	-
CANZ	2538	66	24	41	-	-	-	-	-	-
Japan	1321	35	14	21	-	-	-	-	-	-
FSU	-15286	-	-	-	-	-	76	277	-	-
EEE	-2343	-	-	-	-	-	21	38	-	2
Non-Annex B countries						*52*				

Annex B results	TAC (M95\$)	Actual Emission reductions (required + untraded HA - sinks)	Dom. Red. to reach target	Imports	Untraded Hot Air	Sinks	Nature of Imports			
							CDM (without sinks)	Dom. Red. for IET / JI	Traded Hot Air	Sinks in EEE and FSU
Demanders	28604	750	286	464	-	0	52	97	315	0
Suppliers	-17629	2	-	-	2					
Total Annex B	10974	752	286	464	2					

[5] All prices and costs are given in 1995 US dollars.

Due to the level of their marginal costs, most Annex B countries would reach their emission reduction targets both through domestic reductions and through imports (from JI and CDM projects, or from International Emission Trading). The purchasing world regions would be the USA, the European Union, Canada-Australia-New Zealand (CANZ) and Japan. The total abatement costs (TAC) incurred would be of more than $ 28 billion. The selling regions would be Non-Annex B countries through CDM projects, as well as, for the bulk of it, the Annex B Parties of the Former Soviet Union (FSU)[6] and of the Eastern European Economies (EEE)[7].

FSU and EEE would sell emission reduction units through both hot air and reductions achieved within their own energy sector (either through JI projects or by domestic measures), as long as the marginal abatement cost of these reductions is lower than the international price of permits. Their total benefits would amount to more than $ 17 billion.

Box 1 : Hot air and the POLES model projections

Due to severe economic slowdown, the POLES business as usual (BAU) projections to 2010 for the FSU and EEE energy CO_2 emissions are 305 MtC lower than their 1990 emissions. This represents a substantial reduction of emissions referred to as 'natural Hot Air' in the table below.
Furthermore the Kyoto Protocol 2010 entitlements of Poland - Czech Republic - Hungary - Slovakia are globally 106.8% those of 1990[8]. This allows them to bring 12 MtC additional Hot Air to the 9 MtC of 'natural' hot air in the market.
On the other hand Bulgaria – Romania - Slovenia's Kyoto Protocol target in 2010 is overall 97 % of 1990 emissions[9]. This reduces their volume of tradable Hot Air by 2 MtC.

The total tradable Hot Air amounts to **315** MtC.

		1990 level	2010 level (BaU emissions)	Natural Hot Air	Target (2010 objective / 1990 emissions)	***Resulting tradable Hot Air***	***HA not tradable***
FSU	Russia/ Ukraine/ Baltic States	816	540	277	100%	***277***	***-***
EEE	Poland/ Czech Rep./ Hungary/ Slovakia	174	165	9	106.8%	***21***	***-***
	Bulgaria/ Slovenia/ Romania	67	48	19	97%	***17***	***2***
Total				305		***315***	***2***

Source : POLES model

The 2 MtC of untradable hot air from Bulgaria-Romania-Slovakia are mentioned under the 'HA balance' label in the tables 1, 2 and 3. They are included in the calculation of the total 'emission reductions', as indeed they are actual reductions in emissions.

FSU Hot Air represents 88% of the overall hot air available. Therefore its impact on the market equilibrium is prevailing.

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[6] FSU includes Russia, Ukraine, Estonia, Lithuania, Latvia.

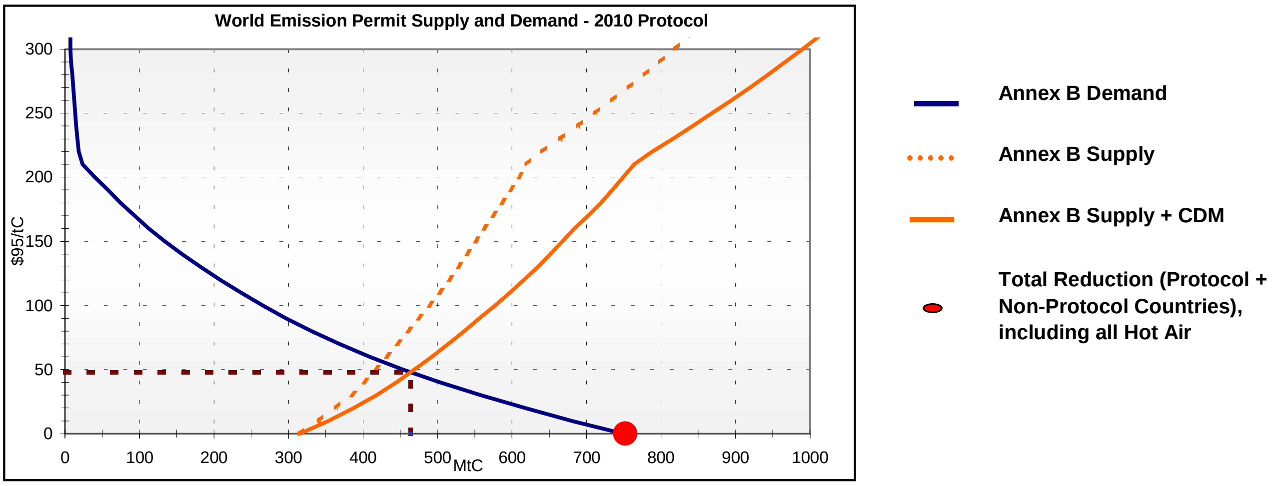
[7] EEE includes Bulgaria, the Czech republic, Hungary, Poland, Romania, Slovakia, Slovenia.

[8] The Base Year / Period for Poland is 1988 and for Hungary it is the average of 1985-1987. See the UNFCCC guidelines on Reporting and Review, FCCCP/CP/1999/7, February 2000, available on : http://www.unfccc.int/resource/docs/cop5/07.pdf.

[9] The Base Year / Period for Bulgaria is 1988, for Romania is 1989 and for Slovenia is 1986. Same reference as note 9 above.

Graph 1 illustrates how the emission permit market would perform in this reference case. The departure point of the supply curves corresponds to the amount of hot air in FSU and EEE: up to 315 MtC, FSU and EEE can provide emission reductions for a nil marginal cost. The 464 MtC imports from purchasing countries are the traded amounts that lead to the $ 48 permit price. The gap between these traded quantities and the total reduction dot at 752 MtC represents the domestic reductions achieved by the countries (288 MtC).

Graph 1 : ID scenario market equilibrium



2. The Hague 'missed compromise' (MC)

The assumptions adopted in this hypothetical case refer to some of the decisions that might have been be made, should COP-6–Part1 have resulted in an agreed compromise.

In addition to the assumptions of the previous ID scenario, the share of proceeds to meet the costs of adaptation in particularly vulnerable developing countries is set to 2% of the Certified Emissions Reductions of a CDM project taking place in a non 'Least Developed Country'. The maximum credits for sinks are set to 3% of base year emissions as had been proposed as a first evaluation of what could be added to the Assigned Amount of the Annex B Parties through LULUCF projects[10] (see figures in annex 1). As at this stage sinks are reported costless in the ASPEN software, importing Annex B countries are assumed to first take advantage of sinks to reach their Kyoto target, before turning to other solutions such as emission credit imports or domestic reductions. Thus, sinks are calculated as the maximum potential for sinks credit. Taking sinks into account is tantamount to leveling-off the other sources of emissions reductions.

The emission permit price declines from 48 $/tC for the ID scenario to 29 $/tC (Table 2) in the The Hague missed compromise (MC scenario), because the overall emissions reductions are smaller (647 MtC instead of 752 MtC), due to the inclusion of sinks for up to 105 MtC. The domestic reductions decrease from 288 to 186 MtC while the volume of trade is almost unchanged at around 460 MtC.

However the sources of exports of permits differ from those of the ID case. Sinks allocated to FSU and EEE raise their emission assigned amounts. They can thus be traded along with hot air. Their amount is referred to as 'Sinks in FSU and EEE' or 'traded sinks'.

Emission reductions from CDM projects decrease from 52 to 34 MtC. The introduction of costless sinks into the current scenario and the consequently lower market price make CDM projects become less competitive. Given the limited volume of emission reduction units from CDM projects, the impact of the 2 % Share of Proceeds is conversely almost insignificant: setting the Share of Proceeds at 0 % keeps the permit price at 29 $/tC and the emission reductions from CDM projects at 34 MtC.

As a consequence of all these changes, the total abatement cost incurred by any Annex B importing country declines as does the benefit for exporting regions FSU and EEE (from more than $ 17 billion to about $ 11 billion).

[10] See FCCC/CP/2000/5/Add.2, pp 13, available on: http://unfccc.org/resource/docs/cop6/05a02.pdf, accessed October 20 2001.

Table 2 : costs and emission reductions of The Hague MC scenario

Permit Price at equilibrium ($/tC)	29

Results summary of current scenario		Purchasers (MtC)				Sellers (MtC)				
						Exports				
Countries	TAC (M95$)	Required emissions reductions =	Dom. Red. to reach target	+ Imports	+ Sinks (dom.+CDM)	CDM (without sinks)	Dom. Red. for IET / JI	Traded Hot Air	Sinks in EEE and FSU	HA balance
USA	**11615**	**513**	**123**	**340**	**50**	**-**	**-**	**-**	**-**	**-**
Europe	**2343**	**136**	**36**	**65**	**36**	**-**	**3**	**-**	**-**	**-**
CANZ	**1408**	**66**	**15**	**41**	**9**	**-**	**-**	**-**	**-**	**-**
Japan	**591**	**35**	**9**	**16**	**10**	**-**	**-**	**-**	**-**	**-**
FSU	**-9849**	**-**	**-**	**-**	**-**	**-**	**53**	**277**	**33**	**-**
EEE	**-1587**	**-**	**-**	**-**	**-**	**-**	**14**	**38**	**10**	**2**
Non-Annex B countries						***34***				

Annex B results	**TAC (M95$)**	**Actual Emission reductions (required + untraded HA - sinks)**	Dom. Red. to reach target	Imports	Untraded Hot Air	**Sinks**	**Nature of Imports**: CDM (without sinks)	Dom. Red. for IET / JI	Traded Hot Air	Sinks in EEE and FSU
Demanders	**15956**	**645**	**184**	**462**	-	**105**	**34**	**70**	**315**	**43**
Suppliers	**-11436**	**2**	**-**	-	**2**					
Total Annex B	**4520**	**647**	**184**	**462**	**2**					

3. The Bonn Agreement

Although the US did not actively take part in the negotiations at COP6-bis and COP 7, it is worth analyzing what would have been the consequence of the adoption of the Bonn-Marrakech Agreement by the US (BM_0), along with the other Parties. Of course this case BM_0 is purely hypothetical but conclusions are worth considering, when compared to the actual situation (BM_1).

The assumptions for BM_0 and BM_1 cases are the same as for the MC case, except for sinks. In this section, sinks are assessed according to the Bonn-Marrakech Agreement. Thus, the maximum potential for sinks considered in ASPEN is calculated as the sum of the projections for:

- the maximum accountable credits for ***forest management*** under Art. 3.4 inscribed in Appendix Z of the Bonn Agreement and modified in the Marrakech Accords,
- credits for ***Afforestation, Reforestation and Deforestation (ARD) activities*** under Art. 3.3 and credits for ***agriculture management*** under Art. 3.4,
- the maximum importable credits for sinks through CDM ARD projects (1% of the Party's base year emissions).

Given the specific situation of FSU and EEE, it is assumed that they would not carry out CDM projects and consequently would not import reduction units from sinks projects through CDM. Therefore, in this study, these sinks (1% of base year emissions) are not included in the total amount allocated to these countries.

a. Bonn-Marrakech with the hypothetical participation of the US

As the US did not take actively part to the Bonn-Marrakech discussions, approximate values for sinks have been set on the basis of data submitted by the US[11] and data from FAO[12] (see annex 2).

Interestingly enough, the results are very close to those displayed for ‘The Hague missed compromise’ (MC) case, with respect to costs as well as emission reductions and their distribution (Table 3).

[11] See FCCC/SBSTA/2000/MISC.6.
[12] See TBFRA-2000 (UN-ECE/FAO)

Table 3: costs and reductions of a hypothetical BM_0 scenario

Permit Price at equilibrium ($/tC)	28

Results summary of current scenario		Purchasers (MtC)				Sellers (MtC)				
						Exports				
Countries	TAC (M95$)	Required emissions reductions =	Dom. Red. to reach target	+ Imports	+ Sinks (dom.+CDM)	CDM (without sinks)	Dom. Red. for IET / JI	Traded Hot Air	Sinks in EEE and FSU	HA balance
USA	**11001**	**513**	**118**	**340**	**55**	**-**	**-**	**-**	**-**	**-**
Europe	**2683**	**136**	**38**	**78**	**20**	**-**	**-**	**-**	**-**	**-**
CANZ	**786**	**66**	**15**	**21**	**30**	**-**	**-**	**-**	**-**	**-**
Japan	**394**	**35**	**9**	**10**	**16**	**-**	**-**	**-**	**-**	**-**
FSU	**-9392**	**-**	**-**	**-**	**-**	**-**	**51**	**277**	**34.5**	**-**
EEE	**-1341**	**-**	**-**	**-**	**-**	**-**	**13**	**38**	**4.0**	**2**
Non-Annex B countries						***32***				

Annex B results	**TAC (M95$)**	**Actual Emission reductions (required + untraded HA - sinks)**	Dom. Red. to reach target	Imports	Untraded Hot Air	**Sinks**	**Nature of Imports** CDM (without sinks)	Dom. Red. for IET / JI	Traded Hot Air	Sinks in EEE and FSU
Demanders	**14863**	**629**	**179**	**450**	-	**121**	**32**	**64**	**315**	**38.5**
Suppliers	**-10733**	**2**	**-**	-	**2**					
Total Annex B	**4130**	**631**	**179**	**450**	**2**					

This clearly shows that the Bonn-Marrakech Agreement would not have brought significant changes from the compromise discussed in The Hague, had the US not withdrawn from the negotiation in-between.

b. The actual Bonn-Marrakech Agreement: no US participation

Since the US did not take part in the Bonn-Marrakech Agreement, the other Annex B countries face an odd situation: emission reduction supply is greater than demand (Table 4). On the demand side, Annex B importing countries or regions must reduce their emissions by 237 MtC, according to the POLES calculations. Accounting for sinks, the remaining required emission reductions amount to 170 MtC. On the supply side, the hot air and sinks surplus for trade is 353 MtC from FSU and EEE.

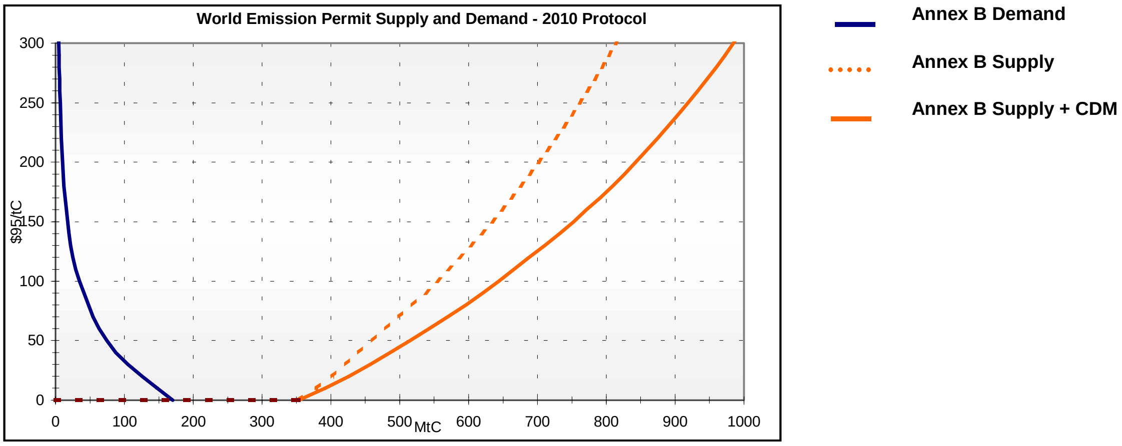
Table 4: The odd Bonn-Marrakech Agreement

	Reduction Objectives for 2010	**Sinks (MtC) (domestic + CDM)** Annex II countries	FSU and EEE (*)	**remaining required emission reductions**	**Surplus (MtC) (**)**
Europe	136	9 + 11		116	
CANZ	66	27 + 3		36	
Japan	35	13 + 3		19	
FSU			34.5		277 + 34.5
EEE			4		38 + 4
Total	237			170	315 + 38.5

(*) No sinks under CDM projects for FSU and EEE.
(**) Hot Air + Sinks to FSU and EEE
Source : ASPEN calculations

Globally speaking, Annex B countries in a 'Kyoto Protocol without the US' could thus reach (and do better than) their target, without any emission reduction action: the emission reductions from the economic collapse of the Economies In Transition more than offsets the projected emission increases of the other Annex B countries over the period 1990-2010. Furthermore, there would be no need for Annex B countries to achieve CDM projects in developing countries. As put by Resources For the Future: "A Kyoto Protocol without the US is like musical chairs with one too many chair – there's a lot of marching around but nothing happens" (Kopp, 2001).

Graph 2: The Bonn-Marrakech Agreement and the US withdrawal.



Actually, the quantity of hot air traded will very likely be lower than what is available. Although it is theoretically possible to face the situation described in graph 2, it seems unlikely that the different Parties will agree on an exchange for free of the emission reduction units from the FSU and EEE hot air. If it were the case, the benefits the latter regions could hope for would then be reduced to nil. Furthermore, some of the importing Parties (especially the EU) seem willing to keep an environmentally significant agreement that is reachable only if part of the hot air is not traded.
In such a situation, FSU and EEE can take advantage of selling only part of their hot air rather than the whole volume of it, as they are the only sellers of emission reductions among Annex B countries. The following Part 4 of the paper extensively considers this issue.

4. The restriction of hot air and the potential market power of Russia and Eastern European countries

The analysis first focuses on the market equilibrium resulting from various assumptions about the amount of hot air traded by FSU and EEE. Of course this analysis is currently fiction. But it may provide guidance for future negotiations in the next Conferences of the Parties, either on the side of importing countries or on that of hot air providing countries.

Apart from the general eligibility conditions for an Annex B Party to participate in the mechanisms[13], there is currently no provision about any restriction on hot air trading in the Bonn-Marrakech Agreement. However, if FSU and EEE brought the whole bulk of their hot air to the market, the permit price would theoretically be nil, as already underlined in the previous section.

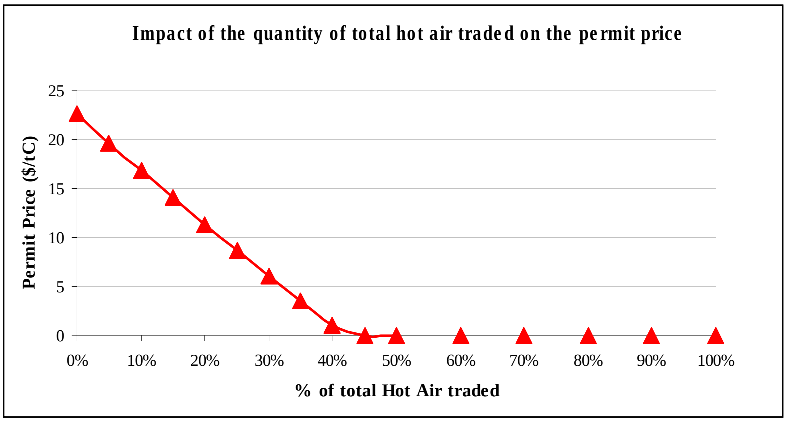
Article 3.13 of the Kyoto Protocol (UNFCCC, 1997) mentions the possibility for Parties to 'bank' their emission reductions for subsequent commitment periods. The Marrakech Accords clearly stipulate that all assigned amounts units can be banked unlimitedly. So, banking of hot air might be an option for restricting trading of this surplus in the first commitment period.

Except for the limitation of the quantity of hot air in the market, the previous assumptions adopted above in the Bonn-Marrakech Agreement section (part 3) still hold in the following analysis.

a. The general relationship between permit price and hot air restriction

Graph 3 shows the relationship between the share of hot air that would be traded and the price of an emission reduction unit that could be decided by sellers or agreed upon by sellers and buyers. Based on ASPEN simulations, it confirms the previous results: as the hot air restriction loosens (i.e. the share of available hot air which is traded increases), the permit price declines. The latter evolves from $ 23 when hot air is not traded, to nil when 45% or more of hot air is traded.

Graph 3

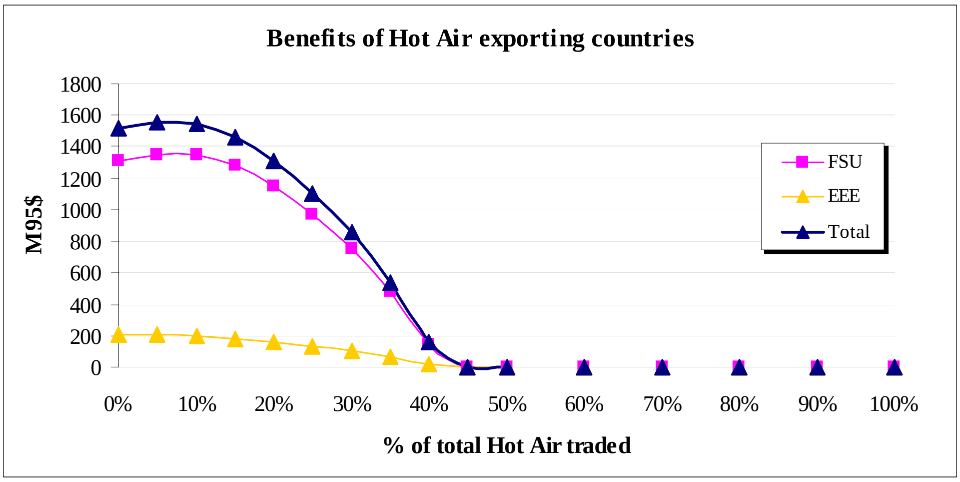


[13] See the Marrakech Accords, http://www.unfccc.int/cop7/documents/accords_draft.pdf

b. Effect of hot air trading restriction on FSU and EEE benefits

Hot air trading restriction also affects the suppliers' benefits. Interestingly enough, their benefits are highest when only 10% of hot air is traded. They decrease from that point on to nil when more than 45 % is traded (Graph 4).
Moreover the US withdrawal seriously affects the FSU and EEE benefits by strongly depressing global demand: they are at most about $ 1,6 billion whereas they were above $ 10 billion in all scenarios assuming US participation.

Graph 4



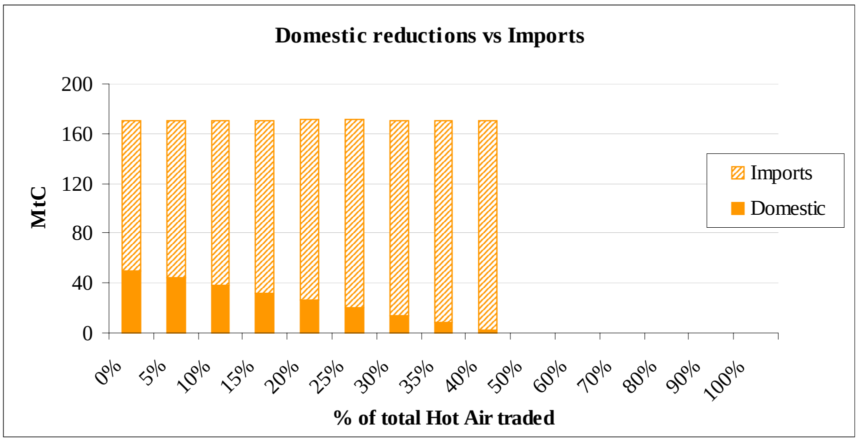
FSU and EEE clearly dominate the international supply of emission reductions. Thus, if they had the market power to do so, they would trade their hot air up to 10% of the total hot air theoretically available. The question is then: do they have this market power?

Up to now, negotiations at the various Conferences of the Parties did not lead to any restriction on hot air. But it is not in the FSU's and EEE's interest to sell out their hot air in the first commitment period. As Manne and Richels (2001) point out, the provision for 'banking' emission reductions could well lead FSU and EEE to exert some market power on other Annex B countries. In keeping part of their emission reduction credits untraded during the first commitment period, FSU and EEE could use them in a subsequent commitment period. They would increase their benefits in the first and second periods, compared to a non-banking option (Manne & Richels, 2001). However the market power of FSU and EEE depends on the extent to which they can bank their emission reductions credits.

c. Effect of hot air trading restriction on Annex B importing countries

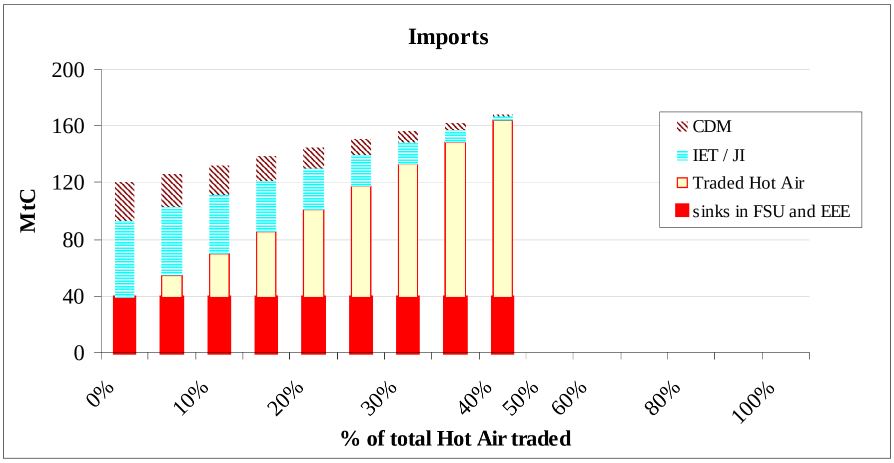
Any restriction on hot air trade clearly entails that Annex B importing countries must operate domestic emission reductions in order to reach their targets. The higher the restriction, the higher the domestic effort will be. But even if hot air is not traded at all, Annex B importing countries will resort to emission permit purchases, JI projects or CDM projects in addition to domestic actions, because the international permit price is lower than the marginal cost of certain domestic measures. Thus, when restriction on hot air is 100 % (no trade during the first commitment period), imports of reduction units still represent about 60 % of the targets (Graph 5).

Graph 5



The nature of imports considerably changes along with the magnitude of hot air restriction but not the geographic origin. With a 55% restriction on hot air, imports only consist in reduction units from the FSU and EEE (traded sinks and hot air). As the restriction increases towards 100 %, emission permit trading and JI form the bulk of imports, whereas CDM projects do not contribute much (Graph 6). Actually emission permit imports and emission reduction units from JI also stem from FSU and EEE, because of the comparatively lower marginal abatement costs of these countries than those of developing countries. The international supply of emission reductions is clearly dominated by FSU and EEE.

Graph 6: nature of imports for Annex B importing countries



The participation of developing countries through the CDM is consequently relatively limited (26% at most, when restriction is 100%). However, this result depends strongly on the hypothesis on the CDM accessibility factor chosen, which is set in this study at 10%. The annex 3 gives details on the impact of the accessibility factor in the BM_1 scenario with 100% hot air banked (i.e. no hot air traded during the first commitment period). It appears that CDM projects almost represent half of the emission reductions achieved, when this access factor is 75 %.

d. No hot air versus market power

When hot air is partially (up to 55 %) or totally banned from trading, the permit price is positive. All the participating Parties face a competitive situation with respect to the remaining emissions reductions needed to meet the global Kyoto Protocol target. This means that emissions reductions are traded until the equalization of marginal abatement costs among Parties.

i. No hot air traded

In that case we analyze the impact of the total withdrawal of hot air from the trading system during the first commitment period in the Bonn-Marrakech Agreement (case $BM_{1,0}$). It amounts to a situation where FSU and EEE sell only emission reduction units obtained from JI projects within their energy sectors. This case is close to the Russian 'Green Investment Scheme' proposal (Vrolijk, 2001), except that in the latter case Russia gets the money first (from the sale of hot air) and then proceeds to emissions reductions in its energy sector (in re-investing all the revenues in such projects).

Table 5 : Case $BM_{1,0}$, costs and emission reductions

Permit Price at equilibrium ($/tC)	23

Results summary of current scenario		Purchasers (MtC)				Sellers (MtC)				
						Exports				
Countries	TAC (M95$)	Required emissions reductions =	Dom. Red. to reach target	+ Imports	+ Sinks (dom.+CDM)	CDM (without sinks)	Dom. Red. for IET / JI	Traded Hot Air	Sinks in EEE and FSU	HA balance
USA	0	-	-	-	-	-	-	-	-	-
Europe	2271	136	31	85	20	-	-	-	-	-
CANZ	673	66	12	24	30	-	-	-	-	-
Japan	340	35	7	11	16	-	-	-	-	-
FSU	-1307	-	-	-	-	-	43.5	-	34.5	277
EEE	-211	-	-	-	-	-	11	-	4	40
Non-Annex B countries						*27*				

Annex B results	TAC (M95$)	Actual Emission reductions (required + untraded HA - sinks)	Dom. Red. to reach target	Imports	Untraded Hot Air	Sinks	Nature of Imports			
							CDM (without sinks)	Dom. Red. for IET / JI	Traded Hot Air	Sinks in EEE and FSU
Demanders	3284	170	50	120	-	66	27	54.5	0	38.5
Suppliers	-1518	317	-	-	317					
Total Annex B	1766	487	50	120	317					

In case FSU and EEE do not trade their hot air at all, the permit price is $ 23 (Table 5), which is close to the MC and BM_0 cases without US participation. The other Annex B countries reach their targets through domestic emission reductions (50 MtC), certified emission reductions from CDM projects (27 MtC), and emission reduction units from Economies In Transition (93 MtC from JI projects and surplus of sinks in FSU and EEE).

The costs are slightly lower than in the BM_0 case for Europe, CANZ and Japan but considerably lower for CANZ and Japan compared to the Missed Compromise case. This is mainly explained by the quantity of sinks credits allocated to these countries in MC and BM cases (see annex 1 and 2). Conversely, as noted above (4.b), FSU and EEE are net losers compared with a situation where the US takes part to the agreement. Their benefits amount to about $ 1.5 billion compared with $ 11 billion in the MC and BM_0 cases and $ 17.6 billion in the ID case.

The actual emission reductions (including the unused hot air), meaning the environmental integrity of the Protocol, are obviously lower than in the previous cases (minus 23% compared with the Bonn-Marrakech Agreement with US - BM_0 -, minus 35% compared with the 'Initial Deal', which, in our study, does not consider sinks). They remain nevertheless significant at 487 MtC (of which 317 MtC of untraded hot air).

ii. FSU and EEE Market power

We now move on to the situation where FSU and EEE exert their market power by selling 10% only of their hot air (see graph 4): case $BM_{1,1}$.

Table 6 : Case $BM_{1,1}$, costs and emission reductions

Permit Price at equilibrium ($/tC)	17

Results summary of current scenario		Purchasers (MtC)				Sellers (MtC)				
						Exports				
Countries	TAC (M95$)	Required emissions reductions =	Dom. Red. to reach target	+ Imports	+ Sinks (dom.+CDM)	CDM (without sinks)	Dom. Red. for IET / JI	Traded Hot Air	Sinks in EEE and FSU	HA balance
USA	**0**	-	-	-	-	-	-	-	-	-
Europe	**1755**	**136**	**24**	**92**	**20**	-	-	-	-	-
CANZ	**526**	**66**	**9**	**27**	**30**	-	-	-	-	-
Japan	**268**	**35**	**5**	**13**	**16**	-	-	-	-	-
FSU	**-1345**	-	-	-	-	-	**34**	**28**	**34.5**	**249**
EEE	**-198**	-	-	-	-	-	**8**	**4**	**4**	**36**
Non-Annex B countries						***21***				

Annex B results	**TAC (M95$)**	**Actual Emission reductions (required + untraded HA - sinks)**	Dom. Red. to reach target	Imports	Untraded Hot Air	**Sinks**	**Nature of Imports**			
							CDM (without sinks)	Dom. Red. for IET / JI	Traded Hot Air	Sinks in EEE and FSU
Demanders	**2549**	**170**	**38**	**132**	-	**66**	**21**	**42**	**31**	**38.5**
Suppliers	**-1542**	**285**	-	-	**285**					
Total Annex B	**1007**	**456**	**38**	**132**	**285**					

As expected the permit price and the total abatement costs for the purchasing countries are lower than in the previous case while the benefits of FSU and EEE are maximized. Still, these benefits are very close to those gained in case $BM_{1,0}$ when no hot air at all is traded.

As expected too, the environmental integrity is decreasing. The overall emission reductions (still including the untraded hot air) are now 455 MtC, which is 28% below the BM_0 case and 39.5% below the ID case.

From cases *i* and *ii*, it appears that FSU and EEE have interest in banking all their hot air during the first commitment period. First of all, exercising their market power does not bring much to them: the maximized benefits through this process appear to be about the same as the benefits drawn from JI projects only (i.e. when no hot air is traded). Then, the more hot air is banked, the more the constraint for FSU and EEE of meeting post-Kyoto emissions reductions commitments may be alleviated (depending on the constraint they would accept in the second commitment period).

From the environmental point of view, it is clear that the efficiency, in terms of overall emissions reductions, would be highest in the first commitment period if hot air was banked. But this option would postpone the hot air management issue into the next commitment period.

Conclusion

The Bonn Agreement and the subsequent Marrakech Accords are considered to be major shifts in the Climate Change negotiations, as all Parties but the US accepted to positively work towards the ratification of the Kyoto Protocol. However our paper shows that it would probably have been better to sign an Agreement in The Hague, when the US still participated in the negotiation. The costs incurred by the participating countries are very similar in either the hypothetical case of The Hague compromise or in the Bonn-Marrakech Agreement, but the environmental efficiency would have been greater in The Hague case with the US participation.

In addition to the fact that it is regretful that the US is not ready to comply with its Kyoto targets, the US withdrawal from the Kyoto Protocol process ironically leaves a great caveat: the hot air available for trade from FSU and EEE more than offsets the required emission reductions of the other Annex B countries.

Consequently, the hot air issue has to be dealt with, if an international emission permit market is to take place. The question is then how to manage hot air trade. Our calculations show that if the market power of FSU and EEE is important, their interest would be to sell only 10 % of their available hot air, in order to maximize their benefits. Conversely, in case of a weak market power of FSU and EEE, negotiations could take place in order to set a minimum permit price.

One way to deal with the surplus of emission reductions from FSU and EEE would be the possibility for these countries to bank part or all of this hot air for subsequent commitment periods in order to meet future reductions objectives. This solution has many advantages: it helps keeping an environmentally significant Protocol; it keeps the permit price high enough so that countries are encouraged to implement policies for domestic emission reductions; it allows Eastern European Economies and countries from the Former Soviet Union to make substantial benefits from the supply of emission reduction units from JI projects and/or from (limited amount of) hot air while ensuring that these countries could meet some more stringent future commitments fairly easily by using the previously banked Assigned Amount Units.

However, in either case, the Bonn-Marrakech Agreement does not leave much room for CDM projects between Annex B Parties and developing countries. Obviously, this result depends strongly on the assumption made on the accessibility of CDM projects and the choice of a 10% access factor. Annex 3 shows the impact of different values of the access factor in the case of the Bonn-Marrakech agreement, without the US, when all hot air is banked.

All the results naturally rely on the POLES emission projections and the marginal abatement cost curves calculations, especially with regards to the quantity of hot air available from FSU and EEE and to the required emissions reductions in 2010 for the other Annex B countries. However, as shown in the paper, the quantity of hot air is about twice the demand for emission reduction units, in the case the US withdraws from the process, given the volume of sinks allocated to the different Parties at the Bonn and Marrakech Conferences. Therefore, even with lower estimates of the quantity of hot air, the qualitative results and the main conclusions would remain similar.

Last, it is important to underline that our analysis assumes that all Annex B Parties but the US have ratified the Kyoto Protocol. Consequently the Marrakech Accords are implemented for those ratifying Parties. Although still uncertain, this hypothesis could well turn into reality by the end of 2002. Furthermore, our analysis is relevant only if FSU and EEE fulfill the eligibility requirements needed to participate in the flexibility mechanisms of the Kyoto Protocol. This particularly supposes that they annually comply with measuring, reporting and communicating obligations with respect to their greenhouse gas emissions and sinks.

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ANNEX 1 : Sinks capped at 3% of base year emissions

	Sinks credits = 3% base year emissions (MtC / yr)
Austria	0.63
Belgium	1.12
Denmark	0.57
Finland	0.61
France	4.53
Germany	9.91
Greece	0.88
Ireland	0.44
Italy	4.25
Luxembourg	0.11
Netherlands	1.79
Portugal	0.52
Spain	2.52
Sweden	0.43
United Kingdom	6.26
EU	34.57
Australia	3.93
Bulgaria	*1.01*
Canada	4.90
Czech Republic	*1.55*
Estonia	*0.33*
Hungary	*0.71*
Iceland	0.08
Japan	10.04
Latvia	*0.29*
Lichtenstein	0.00
Lithuania	*0.42*
Monaco	0.00
New Zealand	0.60
Norway	0.43
Poland	*3.76*
Romania	*1.87*
Russian Feder.	*24.85*
Slovakia	*0.59*
Slovenia	*0.16*
Switzerland	0.43
Ukraine	*7.51*
USA	49.62
World	147.65

ANNEX 2 : Sinks in the Bonn-Marrakech agreement

	Sinks, Appendix Z Bonn text (Art 3.4)*	Art 3.4 Agri Mgmt	Art. 3.3 Credits	Sinks through CDM (1% BYE)	Total	Total excl. Sinks in CDM for FSU and EEE
	MtC/yr	(MtC/yr)	(MtC/yr)	(MtC/yr)	(MtC/yr)	(MtC/yr)
Australia	0	2.18		1.31	3.49	3.49
Austria	0.63			0.21	0.84	0.84
Belgium	0.03			0.37	0.40	0.40
Bulgaria	0.37			0.34	0.71	0.37
Canada	12	4.60		1.63	18.23	18.23
Czech Republic	0.32			0.52	0.84	0.32
Denmark	0.05		0.1	0.19	0.34	0.34
Estonia	0.1			0.11	0.21	0.10
Finland	0.16			0.20	0.36	0.36
France	0.88			1.51	2.39	2.39
Germany	1.24			3.30	4.54	4.54
Greece	0.09			0.29	0.38	0.38
Hungary	0.29			0.24	0.53	0.29
Iceland	0	0.05	0.02	0.01	0.08	0.08
Ireland	0.05		0.91	0.15	1.11	1.11
Italy	0.18		0.47	1.42	2.07	2.07
Japan	13			3.35	16.35	16.35
Latvia	0.18			0.10	0.28	0.18
Lichtenstein	0.01			0.00	0.01	0.01
Lithuania	0.28			0.14	0.42	0.28
Luxembourg	0.01			0.04	0.05	0.05
Monaco	0			0.00	0.00	0.00
Netherlands	0.01		0.04	0.60	0.65	0.65
New Zealand	0.2		7.71	0.20	8.11	8.11
Norway	0.4		0.02	0.14	0.56	0.56
Poland	0.82			1.25	2.07	0.82
Portugal	0.22			0.17	0.39	0.39
Romania	1.1			0.62	1.72	1.10
Russian Feder.	33			8.28	41.28	33.00
Slovakia	0.51			0.20	0.71	0.51
Slovenia	0.36			0.05	0.41	0.36
Spain	0.67			0.84	1.51	1.51
Sweden	0.58			0.19	0.77	0.77
Switzerland	0.5	0.01		0.14	0.65	0.65
Ukraine	1.11			2.50	3.61	1.11
United Kingdom	0.37	0.25	0.56	2.09	3.27	3.27
USA	28	10.40		16.54	54.94	54.94
Total	97.72	7.09	9.83	49.25	174.29	159.93

*: The figure for Russia for Art 3.4 forest management is 33 MtC (according to what was agreed upon in Marrakech)

Sources:

- Appendix Z: FCCC/CP/2001/L.11/Rev.1, 27 July 2001 (available on: http://www.unfccc.int/resource/docs/cop6secpart/l11r01.pdf) + Marrakech Accords & The Marrakech Declaration, advance unedited version, part K2, available on http://unfccc.org/cop7/documents/accords_draft.pdf (03/12/2001)

ANNEX 3 : Impact of the CDM access factor

CDM access factor	Domestic Action	CDM	IET	Sinks in FSU and EEE
100%	10.0%	56.0%	11.5%	22.5%
75%	12.5%	51.0%	14.0%	22.5%
50%	16.0%	43.5%	18.0%	22.5%
25%	22.5%	30.5%	24.5%	22.5%
10%	29.5%	16.0%	32.0%	22.5%
0%	38.0%	0.0%	39.5%	22.5%

Source: POLES & ASPEN calculations

Hypotheses: Bonn-Marrakech Agreement, no US participation, all hot air is banked for subsequent commitment periods (and therefore not traded during the first commitment period).

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